

REMARKS/ARGUMENTS

The Office Action mailed April 4, 2006 has been carefully considered. Reconsideration in view of the following remarks is respectfully requested.

Upon entry of this amendment, claims 1-20 are pending in the application. Claims 2-7 and 13-20 are hereby withdrawn from consideration; claims 1 and 8-12 are hereby cancelled; and new claims 21-40 are hereby added to the application.

Claims 1 and 5 stand rejected under 35 U.S.C. 102(b) as allegedly being anticipated by Kobayashi (US 5,351,872 A).

Claims 2-4,6-8 and 13-20 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kobayashi (US 5,351,872 A) in view of Leu (US 6,648,215 B2).

Claim 9 stands rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kobayashi (US 5,351,872 A) in view of Stoll (US 4,715,264 A).

Claims 10-12 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kobayashi (US 5,351,872 A) in view of Leu (US 6,648,215 B2) and further in view of Stoll (US 4,715,264 A).

The 35 U.S.C. § 102(b) Rejection

Claims 1 and 5 stand rejected under 35 U.S.C. 102(b) as allegedly being anticipated by Kobayashi (US 5,351,872 A).

Kobayashi ~~discloses~~ ^{describes STEP} a die bonding apparatus with a chip gripper in the form of a die collet. The die collet is moved up and down by means of a linear motor.

New claim 21 is directed to a method for picking a semiconductor chip from a foil by means of a chip gripper that bears pneumatically in a pressure chamber of a bondhead. As

Kobayashi fails to disclose a chip gripper that bears pneumatically in a pressure chamber of a bondhead, it cannot be maintained that Kobayashi anticipates new claim 21.

New claim 31 is directed to a method for picking a semiconductor chip from a foil by means of a chip gripper that is connected to a piston pneumatically driven by a first pressure applied to a first pressure chamber and a second pressure applied to a second pressure chamber of a bondhead. As Kobayashi fails to disclose a chip gripper that bears pneumatically in a pressure chamber of a bondhead, it cannot be maintained that Kobayashi anticipates new claim 31.

The 35 U.S.C. § 103(a) Rejections

Claims 2-4, 6-8 and 13-20 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kobayashi (US 5,351,872 A) in view of Leu (US 6,648,215 B2).

Kobayashi states in column 8, lines 26 seq.:

The actual die bonding can be executed as follows:

(1) ...

(2) The Y-axis robot 13b is driven to move the semiconductor die 2 mounted on the wafering station 19 over the collet 12, and then the linear motor 21 is driven to move the collet 12 downward to a position a distance b higher than the height position h of the semiconductor die 2 in accordance with the uniformly accelerated and decelerated motion (as described with reference to FIG. 6) as shown by C₁ in FIG. 8(c). Further, the collet 12 is moved downward to the position a distance a higher than the height position h of the semiconductor die 2 in accordance with the uniform motion (as described with reference to FIG. 5) as shown by C₂ in FIG. 8(c). Further, the collet 12 is kept at this height position for a time period as shown by C₃ in FIG. 8(c).

(3) Successively, the push-up needles 31 (arranged under the semiconductor die 2) and the collet

12 are moved upward simultaneously by a distance c in accordance with the uniform motion as shown by C_4 in FIG. 8 (c). Further, the vacuum equipment (not shown) connected to the pipe 34 is actuated to evacuate the pipe 34, with the result that the semiconductor die 2 pushed up by the push-up needles 31 is sucked by the collet 12 securely.

Here, in case the upward travel speed of the push-up needles 31 is higher than that of the collet 12, the push-up needles 31 collide against the collet 12, so that the upward travel speed of the collet 12 exceeds a predetermined set value. In this case, since the difference between the actual position and the target position of the collet 12 increases, there exists a problem in that the control section 32 decreases the upward travel speed of the collet 12 and thereby an excessive pressure is applied between the collet 12 and the push-up needles 31, with the result that the semiconductor die 2 is damaged. In this embodiment, however, whenever the collet 12 and the push-up needles 31 are moved simultaneously in the upward direction, the upward travel speed of the collet 15 will not be decreased below a predetermined value even if the actual position of the collet 12 is higher than the target position, thus solving the above-mentioned problem.

(4) Thereafter, the collet 12 is moved upward to the original point in accordance with the uniformly accelerated and decelerated motion as shown by C_5 in FIG. 7(c).

After step 2 the die collet 12 is placed above the semiconductor chip. During step 3 the push-up needles 31 and the die collet 12 are moved and must be moved upward simultaneously because otherwise the distance between the die collet 12 and the semiconductor chip either increases or in the other worse case the push-up needles 31 press the semiconductor chip with excessive pressure against the die collet with the result that the semiconductor chip is damaged and therefore destroyed. This is a severe problem. Two different drives, namely not shown

driving means for the push-up needles 31 (col. 4, lines 4-8) and the linear motor 21 for the die collet 12 must be controlled to run with exactly the same speed. The present invention as claimed in claims 21 and 31 avoids such a simultaneous movement.

Claim 21 is directed to a method for picking a semiconductor chip from a foil by a chip gripper, wherein the chip gripper is connected to a piston bearing pneumatically in a pressure chamber of a bondhead, wherein the bondhead is movable by means of a drive in a direction designated as z direction, wherein the chip gripper is movable relative to the bondhead in said z direction, and wherein the detaching of the semiconductor chip from the foil takes place with the aid of a needle, the method comprising the following steps:

- a) Applying a predetermined pressure to the pressure chamber of the bondhead so that the chip gripper takes up a limit position and lowering the bondhead to a predetermined position z_0 ,
- b) Raising the needle to a predetermined position z_1 , whereby the needle raises the semiconductor chip in order to bring the semiconductor chip into contact with the chip gripper and then to move the chip gripper out of said limit position, while the bondhead remains at the position z_0 , and
- c) Raising the bondhead, whereby the semiconductor chip detaches itself from the needle.

The method as recited in claim 21 can be described in short as consisting of the following three phases:

- a) The bondhead is lowered to a predefined position,
- b) The needles are pushed up while the bondhead remains at its position, and
- c) The bondhead is moved up and away.

As has been explained above the apparatus of Kobayashi is not capable of performing this method without damaging the semiconductor chip and consequently fails to disclose step b. Leu teaches a method of placing a semiconductor chip on a substrate where the chip gripper (pick-up

tool) is first brought into an upper limit position with regard to the bondhead and then moves from the upper limit position in the direction of a lower limit position and presses the semiconductor chip onto the adhesive. In principle, the chip gripper of Leu falls towards the semiconductor chip under the gravitational force created by its own weight. To achieve this, the chip gripper of Leu bears pneumatically on the bondhead.

According to the Manual of Patent Examining Procedure (M.P.E.P.),

To establish a *prima facie* case of obviousness, three basic criteria must be met. First there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in the applicant's disclosure.¹

Leu does not address the problems occurring with the picking of the semiconductor chip. Leu concerns a method of placing a semiconductor chip on a substrate. For this reason, the combination of Kobayashi and Leu cannot and does not result in the method as recited in claim 21. If inversely the teaching of Kobayashi would be applied to the apparatus of Leu then the apparatus of Leu had to be modified such that the chip gripper and the needles could be moved upward simultaneously. From this it follows that the combination of these prior art references does not result in the method as recited in claim 21 and therefore does not teach or suggest all the limitations of claim 21.

Neither Kobayashi nor Leu disclose an apparatus where the chip gripper is connected to a piston pneumatically driven by a first pressure applied to a first pressure chamber and a second pressure applied to a second pressure chamber of a bondhead. From this it follows that the

¹ M.P.E.P § 2143.

combination of these prior art references does not result in the method as recited in claim 31 and therefore does not teach or suggest all the limitations of claim 31.

In view of this, it is respectfully asserted that claims 21 and 31 are now in condition for allowance.

Claim 9 stands rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kobayashi (US 5,351,872 A) in view of Stoll (US 4,715,264 A).

Claim 9 has been cancelled.

Claims 10-12 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kobayashi (US 5,351,872 A) in view of Leu (US 6,648,215 B2) and further in view of Stoll (US 4,715,264 A).

Claims 10-12 have been cancelled.

New claims 22-30 depend from and thereby incorporate the limitations of claim 21. New claims 32-40 depend from and thereby incorporate the limitations of claim 31. It therefore follows that Kobayashi and Leu also contain insufficient teaching to render claims 22-30 and 32-40 obvious.

Conclusion

It is believed that this Amendment places the above-identified patent application into condition for allowance. Early favorable consideration of this Amendment is earnestly solicited.

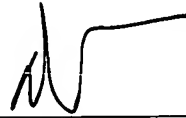
If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Please charge any additional required fee or credit any overpayment not otherwise paid or credited to our deposit account No. 50-1698.

Respectfully submitted,

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